

1

SELECTION OF OPTIMAL CHANNEL FOR RATE DETERMINATION

RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. §120 as a continuation of U.S. application Ser. No. 13/428,329, entitled "SELECTION OF OPTIMAL CHANNEL FOR RATE DETERMINATION," filed on Mar. 23, 2012, now U.S. Pat. No. 8,897,860, which claims priority under 35 U.S.C. §119(e) to U.S. Provisional Application Ser. No. 61/467,599, entitled "SELECTION OF OPTIMAL CHANNEL FOR RATE DETERMINATION," filed on Mar. 25, 2011, both of which are hereby incorporated herein by reference in their entireties for all purposes.

BACKGROUND

1. Technical Field

Examples disclosed herein relate generally to the detection of cardiac function in a patient, and more particularly to the detection of cardiac function and the treatment of cardiac conditions in an ambulatory medical device, such as a wearable defibrillator.

2. Discussion

With a wearable defibrillator worn by an ambulatory patient, the patient's electrocardiogram (ECG) signal is obtained from body surface electrodes. Determining the true characteristics of an ambulatory patient's cardiac cycle based on an ECG signal in this manner can be difficult. Electrical noise and electrode fall-off frequently degrade the quality of the ECG signal. In addition, the characteristics of ECG signals vary from patient to patient due to factors such as the patient's state of health, individual physiology, and electrode positions on the body surface.

Known ambulatory wearable defibrillators, such as the LifeVest® Wearable Cardioverter Defibrillator available from Zoll Medical Corporation of Chelmsford, Mass., use four ECG sensing electrodes in a dual-channel configuration. That is, an electrical signal provided by one of the four ECG sensing electrodes is paired with the electrical signal provided by another of the four ECG sensing electrodes to form a channel. This arrangement of ECG sensing electrodes is usually suitable because in most cases it is rare that noise or electrode movement affects the entire body circumference. The dual-channel configuration provides redundancy and allows the system to operate on a single channel if necessary. Because signal quality also varies from patient to patient, having two channels provides the opportunity to have improved signal pickup, since the ECG sensing electrodes are located in different body positions.

SUMMARY

Examples disclosed herein are directed to a wearable medical device that monitors ECG signals received on a plurality of channels and interprets the ECG signals according to a set of preferences. This set of preferences indicates which channels and detection methods are more likely to provide accurate results for the patient wearing the wearable medical device. By interpreting ECG signals according to the set of preferences, the wearable medical device decreases the frequency of falsely detected cardiac malfunctions.

According to one example, an ambulatory medical device is provided. The device includes a plurality of electrodes disposed at spaced apart positions about a patient's body and a control unit. The control unit includes a sensor interface

2

coupled to the plurality of electrodes and configured to receive a first ECG signal from a first pairing of the plurality of electrodes and to receive a second ECG signal from a second pairing of the plurality of electrodes, a memory storing information indicating a preferred pairing, the preferred pairing being either the first pairing or the second pairing and a processor coupled to the sensor interface and the memory and configured to resolve conflicts between interpretations of first ECG signal and the second ECG signal in favor of the preferred pairing. In some examples, the first pairing includes electrodes that are distinct from the electrodes included in the second pairing. In other examples, one of the plurality of electrodes is common between the first and second pairings. The device may include a plurality of electrodes that are integrated into a garment that is worn about a patient's body. In addition, the interpretations of the ECG signals may detect heartbeats.

According to another example, a method of monitoring ECG signals is provided. In some examples, the method is executed by an ambulatory medical device as described herein. The method includes acts of determining a first interpretation of a first ECG signal provided by a first channel of the plurality of channels, determining a second interpretation of a second ECG signal provided by a second channel of the plurality of channels, determining which one of the first channel and the second channel provides a more reliable ECG signal and resolving a conflict between the first interpretation and the second interpretation based upon which of the first channel and the second channel is determined to provide the more reliable ECG signal.

According to at least one example, an ambulatory medical device is provided. The device includes a plurality of electrodes disposed at spaced apart positions about a patient's body and a control unit. The control unit includes a sensor interface, a memory and a processor. The sensor interface is coupled to the plurality of electrodes and configured to receive a first ECG signal from a first pairing of the plurality of electrodes and to receive a second ECG signal from a second pairing of the plurality of electrodes. The memory stores information indicating a preferred pairing, the preferred pairing being either the first pairing or the second pairing. The processor is coupled to the sensor interface and the memory and is configured to resolve conflicts between interpretations of first ECG signal and the second ECG signal in favor of the preferred pairing.

The device may further comprise a garment that is configured to be worn about the patient's body. The plurality of electrodes may be integrated into the garment. The plurality of electrodes may include adhesive electrodes. In some examples, the interpretations of the ECG signals may detect heartbeats.

In the device, the information indicating the preferred pairing may include information indicating a first heart rate detection method preferred for the first pairing and a second heart rate detection method preferred for the second pairing. The processor may be further configured to interpret the first ECG signal using the first heart rate detection method and interpret the second ECG signal using the second heart rate detection method.

In the device, the processor may be further configured to determine a first confidence level for the first pairing, determine a second confidence level for the second pairing, determine the preferred pairing with reference to the first confidence level and the second confidence level and store the information indicating the preferred pairing in the memory. In addition, the processor may be configured to determine the first confidence level by comparing the first ECG signal to